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a second pressing member for pressing the projecting portion of the moving body into pressure contact with the tapered portion of the rotational body.

IN THE ABSTRACT:

Delete the abstract now of record and insert therefor the new abstract submitted herewith on a separate sheet.

ADDITIONAL FEES:

No additional fees are believed required; however, should it be determined that a fee is due, authorization is hereby given to charge any such fee to our Deposit Account No. 01-0268.

REMARKS

In the last Office Action, the Examiner rejected claims 29-33 and 35 under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,332,941 to Honda ("Honda '941"), U.S. Patent No. 4,945,275 to Honda ("Honda '275") or NAIA. Claim 34 was rejected under 35 U.S.C. §103(a) as being unpatentable over Honda '941 or NAIA in view of U.S. Patent No. 5,783,899 to Okazaki or U.S. Patent No. 5,198,935 to Imanari et al. ("Imanari"). Claims 36, 37, 39 and 41 were

rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,041,132 to Miyata. Claim 40 was rejected under 35 U.S.C. §103(a) as being unpatentable over Miyata in view of Imanari or Okazaki. Claims 42, 43, 45, 46 and 48 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,103,128 to Adachi. Claims 44 and 47 were rejected under 35 U.S.C. §103(a) as being unpatentable over Adachi in view of Imanari or Okazaki. Claim 38 was objected to as being dependent upon a rejected base claim, but indicated to be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Claims 49 and 50 were allowed over the prior art of record.

Applicants and applicants' counsel note with appreciation the indication of allowable subject matter concerning claims 38, 49 and 50. However, for the reasons noted below, applicants respectfully submit that amended independent claims 29, 36, 42, 46, 49 and 50 and dependent claims 30-35, 37-41, 43-45 and 47-48 also patentably distinguish from the prior art of record.

In accordance with the present response, independent claims 29, 36, 42 and 46 and allowed independent claims 49 and 50 have been amended to more broadly recite the elements of the supersonic motor which is one component of the linear

motion mechanism (claims 29, 36, 42, 49, 50) and of the pivotal motion mechanism (claim 46) and which, as further discussed below, is not necessary to patentably distinguish the claims from the prior art of record. A new abstract which reflects the invention to which the claims are directed has been substituted for the previously submitted abstract.

The amendment to the claims made herein does not raise new issues requiring further search and/or consideration. Instead, independent claims 29, 36, 42 and 46 and allowed independent claims 49 and 50 have been amended to more broadly recite the elements of the supersonic motor which is one component of the linear motion mechanism (claims 29, 36, 42, 49, 50) and of the pivotal motion mechanism (claim 46), and a new abstract which reflects the invention to which the amended claims are directed has been substituted for the previously submitted abstract, thereby placing the application in condition for allowance or otherwise reducing the issues which remain for appeal.

Attached hereto is a marked-up version of the changes made to the abstract and claims by the current amendment. The attached pages i-viii are captioned "**VERSION WITH MARKINGS TO SHOW CHANGES MADE**".

Applicants respectfully request reconsideration of their application in light of the following discussion.

Brief Summary of the Invention

The present invention is directed to a linear motion mechanism or pivotal motion mechanism and to an electronic apparatus equipped with the linear motion mechanism or the pivotal motion mechanism.

With reference to the embodiment shown in Figs. 1, 2 and 3A-3E, the linear motion mechanism comprises a supersonic motor 1 having a shaft 6, a vibrating body 3 supported by the shaft 6, a piezoelectric element 2 having an electrode pattern 2a, 2b and being driven by a voltage signal to undergo expansion and compression movement to vibrationally drive the vibrating body 3, and a rotor 4 disposed on the vibrating body 3 for undergoing rotation about a longitudinal axis of the shaft 6 in accordance with vibration of the vibrating body 3. A transmission mechanism 13 (e.g., a cam, a pinion or a rack and gear) is disposed on the rotor 4 for rotation therewith. A moving body 14 undergoes linear movement in a direction crosswise to the longitudinal axis of the shaft 6 in accordance with rotation of the transmission mechanism 13. A pressurizing mechanism 15 presses the moving body 14 into pressure contact with the transmission mechanism 13. The supersonic motor 1 is preferably mounted on a support member 18. A guide member 16 is mounted on the support member 18 for guiding the linear movement of the moving body 14.

In another embodiment, as shown in Fig. 13, a detecting device 105 detects an amount of linear movement of the moving body 14, and a control circuit 101 controls a position of the moving body 14 in accordance with the amount of linear movement detected by the detecting device 105.

In another aspect, the present invention is directed to a pivotal motion mechanism. With reference to the embodiment shown in Fig. 10, the pivotal motion mechanism has a supersonic motor 1 as described above for the embodiment of the linear motion mechanism. A transmission member 13 is connected to the rotor 4 for rotation therewith. A moving body 37 is mounted for undergoing pivotal movement about a pivot point 40a in accordance with rotation of the transmission member 13. A pressurizing mechanism 15 presses the moving body 37 into pressure contact with the transmission member 13.

In another aspect, the present invention is directed to an electronic device comprising a linear motion mechanism according to any of the foregoing embodiments, and a load member (e.g., fiber 52, lens 53 and connector 54 shown in Fig. 14) disposed on the moving body 14 of the linear motion mechanism.

By the foregoing construction of the linear motion mechanism according to the present invention, rotational

motion of a rotor in a supersonic motor is converted to smooth and precise linear motion of a moving body. Furthermore, the linear motion mechanism according to the present invention has a reduced size and operates with low power consumption as compared to the conventional art.

Traversal of Prior Art Rejections

Claims 29-33 and 35 were rejected under 35 U.S.C. §103(a) as being unpatentable over Honda '941, Honda '275 or NAIA. Applicants respectfully traverse this rejection and submit that the teachings of Honda '941, Honda '275 or NAIA do not disclose or suggest the subject matter recited in amended independent claim 29 and dependent claims 30-33 and 35.

Independent claim 29 is directed to a linear motion mechanism and requires a supersonic motor having a rotor which is rotationally driven by vibration of a vibrating body having a piezoelectric element, a transmission mechanism disposed on the rotor for rotation therewith, a moving body for undergoing linear movement in a direction crosswise to a longitudinal axis of a rotational shaft of the rotor in accordance with rotation of the transmission mechanism, and a pressurizing mechanism for pressing the moving body into pressure contact with the transmission mechanism. No corresponding structural combination is disclosed or suggested by Honda '941, Honda '275 or NAIA.

The Examiner contends that each of Honda '941, Honda '275 and NAIA discloses a linear motion mechanism having a moving body and a transmission mechanism, where the rotary motion of a piezoelectric motor is converted to linear motion. While acknowledging that Honda '941, Honda '275 and NAIA do not explicitly teach a pressurizing mechanism for pressing the moving body into pressure contact with the transmission mechanism, the Examiner contends that the provision of a pressurizing mechanism in the linear motion mechanism of Honda '941, Honda '275 and NAIA would have been obvious to one of ordinary skill in the art at the time the invention was made in order to provide "a necessary element to keep the parts working together" since "an inoperable device would be self evident (self revealing) and need correction." Applicants respectfully disagree with the Examiner's contentions.

It is well settled that the Examiner must satisfy his burden of establishing a prima facie case of obviousness by showing that some objective teaching or suggestion in the applied prior art taken as a whole and/or knowledge generally available to one of ordinary skill in the art would have led that person to the claimed invention, including each and every limitation of the claims, without recourse to the teachings in applicants' disclosure. See generally, In re Rouffet, 47 USPQ2d 1453, 1456, 1457-1458 (Fed. Cir. 1998); In re Oeticker,

24 USPQ2d 1443, 1446-47 (Fed. Cir. 1992). In this case, the Examiner has failed to carry his burden of making out a prima facie case of obviousness with respect to the subject matter recited in independent claim 29.

The principal issue is whether one of ordinary skill in the art would have found it obvious to modify the linear motion mechanism of Honda '941, Honda '275 and NAIA in order to provide the same with a pressurizing mechanism for pressing the moving body into pressure contact with the transmission mechanism, as specified in independent claim 29. The Examiner contends that the provision of such pressurizing mechanism would be necessary in order to render the linear motion mechanisms disclosed by Honda '941, Honda '275 and NAIA operable. However, the Examiner has not indicated how or why the linear motion mechanisms disclosed by Honda '941, Honda '275 and NAIA are inoperable. Upon careful review of Honda '941, Honda '275 and NAIA, applicants cannot find any problem with the operability of the linear motion mechanisms disclosed by these references. Furthermore, applicants cannot find any reason why such a pressurizing mechanism would be necessary in the linear motion mechanisms disclosed by Honda '941, Honda '275 and NAIA in order to "keep the parts working together", as proposed by the Examiner. Applicants therefore respectfully submit that the Examiner's reasoning for

modifying the references to Honda '941, Honda '275 and NAIA is not supported by the evidence of record.

Moreover, it is unclear how the linear motion mechanisms disclosed by the cited references would be modified as proposed by the Examiner to provide a pressurizing mechanism for pressing the moving body into pressure contact with the transmission mechanism. For example, in Honda '941, a moving member 17 is linearly moved by rotation of a rotor 2 via a rotary transmission member 16 (Fig. 13). Where would the proposed pressurizing mechanism be positioned in the linear motion mechanism disclosed by Honda '941 in order to press the moving member 17 into pressure contact with the rotary transmission member 17?

Moreover, the proposed modifications of the cited references are improper because the prior art teaches away from the claimed modifications. A reference teaches away when a person of ordinary skill in the art, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that the applicants took. In re Gurley, 31 USPQ2d 1130, 1131 (Fed. Cir. 1994). Stated otherwise, a reference teaches away if it suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the

applicants. W.L. Gore & Assocs. v. Garlock, Inc., 220 USPQ 303, 311 (Fed. Cir. 1983) (the totality of a reference's teachings must be considered), cert. denied, 469 U.S. 851 (1984); In re Caldwell, 138, USPQ 243, 245 (CCPA 1969) (reference teaches away if it leaves the impression that the product would not have the properties sought by the applicant).

In this case, the prior art teaches away from the claimed combination. For example, Honda '941 is concerned with providing an ultrasonic motor having minor wear and tear (col. 1, lines 33-35). More specifically, a primary object of Honda '941 is to avoid the use of a spring for bringing electrodes into contact with a rotor (col. 1, lines 18-27). Honda '941 achieves this object by providing a rotor which itself is a spring (col. 1, lines 29-31). Thus, the modification of Honda '941 proposed by the Examiner would be contrary to the reference's object in reducing wear and tear of parts. In contrast, the present invention recited in independent claim 29 explicitly requires a pressurizing mechanism for pressing the moving body into pressure contact with the transmission mechanism. In accordance with the present invention the, provision of a pressurizing mechanism for pressing the moving body into pressure contact with the transmission mechanism insures that rotational motion of a

rotor in a supersonic motor is converted to smooth and precise linear motion of the moving body. Thus, contrary to the Examiner's contention, one of ordinary skill in the art at the time the invention was made would not have been led to modify the cited references to provide a pressurizing mechanism for pressing the moving body into pressure contact with the transmission mechanism, as required by independent claim 29.

Claims 30-33 and 35 depend on and contain all of the limitations of independent claim 29 and, therefore, distinguish from the references at least in the same manner as claim 29.

Moreover, there are separate grounds for patentability of several of dependent claims 30-33 and 35.

Claims 30-32 include the additional limitation that the transmission mechanism includes a cam, a pinion, and a rack and a gear, respectively. Claim 33 includes the additional limitation that the supersonic motor is mounted on a support member, and that the linear motion mechanism further comprises a guide member mounted on the support member for guiding the linear movement of the moving body. The Examiner did not address these limitations in the statement of rejection. It is clear, however, that the prior art of record does not disclose or suggest the structural features required by claims 30-33.

In view of the foregoing, applicants respectfully request that the rejection of claims 29-33 and 35 under 35 U.S.C. §103(a) as being unpatentable over Honda '941, Honda '275 or NAIA be withdrawn.

Claim 34 was rejected under 35 U.S.C. §103(a) as being unpatentable over Honda '941, Honda '275 or NAIA in view of Okazaki or Imanari. Applicants respectfully traverse this rejection and submit that the combined teachings of Honda '941, Honda '275 or NAIA and Okazaki or Imanari do not disclose or suggest the subject matter recited in claim 34.

Claim 34 depends on and contains all of the limitations of independent claim 29 and, therefore, distinguishes from the references to Honda '941, Honda '275 or NAIA at least in the same manner as claim 29.

The Examiner cited the secondary references to Okazaki and Imanari for their disclosure of a position sensor and a servo loop for controlling a motor. However, Okazaki and Imanari clearly do not disclose or suggest a linear motion mechanism having a pressurizing mechanism for pressing the moving body into pressure contact with the transmission mechanism, as required by independent claim 29, from which claim 34 depends. Since Okazaki and Imanari do not disclose or suggest these features, they do not cure the deficiencies of Honda '941, Honda '275 or NAIA. Accordingly, one of

ordinary skill in the art would not have been led to modify the references to attain the claimed subject matter.

In view of the foregoing, applicants respectfully request that the rejection of claim 34 under 35 U.S.C. §103(a) as being unpatentable over Honda '941, Honda '275 or NAIA in view of Okazaki or Imanari be withdrawn.

Claims 36, 37, 39 and 41 were rejected under 35 U.S.C. §103(a) as being unpatentable over Miyata. Applicants respectfully traverse this rejection and submit that the teachings of Miyata do not disclose or suggest the subject matter recited in claims 36, 37, 39 and 41.

Amended independent claim 36 is directed to a linear motion mechanism and requires a supersonic motor having a rotor which is rotationally driven by vibration of a vibrating body having a piezoelectric element, a transmission member disposed on the rotor for rotation therewith, the transmission member having a tapered portion varying in thickness along a direction generally perpendicular to a longitudinal axis of a rotational shaft of the rotor, a moving body having an end portion in contact with the transmission member for undergoing linear movement in a direction generally parallel to the longitudinal axis of the rotational shaft in accordance with rotation of the transmission member, and a pressurizing

mechanism for pressing the moving body into pressure contact with the transmission member. No corresponding structural combination is disclosed or suggested by the prior art of record.

Miyata discloses in Figs. 5 and 10 a blood pump in which rotation of an ultrasonic motor 42 is converted through a cam mechanism 43 (transmission mechanism) into reciprocating movement of a pusher-plate 3 (moving body). However, Miyata clearly does not disclose or suggest a transmission member having a tapered portion varying in thickness along a direction generally perpendicular to a longitudinal axis of a rotational shaft of the rotor, and a pressurizing mechanism for pressing the moving body into pressure contact with the transmission member, as required by independent claim 36. Should the Examiner maintain the rejection of claim 36 on the basis of Miyata, or reject the claims over one or more of the prior art of record cited but not relied upon by the Examiner in the last Office Action, applicants respectfully request that the Examiner specifically point out the teachings in such references which disclose or suggest the specific structure of the transmission mechanism and the pressurizing member recited in claim 36.

In the statement of rejection, the Examiner states that "the omission of an element with the consequent loss of

its function has long been held to be within the skill expected of the routineer and therefore obvious to one of ordinary skill in the art." Applicants do not understand the Examiner's statement concerning the "omission of an element" and are unclear as to the specific "element" being referred to. Applicants respectfully request clarification of this statement and the identification of the "element" in the next PTO communication.

Claims 37, 39 and 41 depend on and contain all of the limitations of independent claim 36 and, therefore, distinguish from the reference at least in the same manner as claim 36.

Moreover, there is a separate grounds for patentability of dependent claim 37 which includes the additional limitation that the moving body has a projecting portion for contacting the tapered portion of the transmission member. As noted above, Miyata does not disclose or suggest a transmission member disposed on the rotor for rotation therewith and having a tapered portion.

In view of the foregoing, applicants respectfully request that the rejection of claims 36, 37, 39 and 41 under 35 U.S.C. §103(a) as being unpatentable over Miyata be withdrawn.

Claim 40 was rejected under 35 U.S.C. §103(a) as being unpatentable over Miyata in view of Okazaki or Imanari. Applicants respectfully traverse this rejection and submit that the combined teachings of Miyata and Okazaki or Imanari do not disclose or suggest the subject matter recited in claim 40.

Claim 40 depends on and contains all of the limitations of independent claim 36 and, therefore, distinguishes from the reference to Miyata at least in the same manner as claim 36.

The Examiner cited the secondary references to Okazaki and Imanari for their disclosure of a position sensor and a servo loop for controlling a motor. However, Okazaki and Imanari clearly do not disclose or suggest a linear motion mechanism having a transmission member having a tapered portion varying in thickness along a direction generally perpendicular to a longitudinal axis of a rotational shaft of the rotor, and a pressurizing mechanism for pressing the moving body into pressure contact with the transmission member, as required by independent claim 36 from which claim 40 depends. Since Okazaki and Imanari do not disclose or suggest these features, they do not cure the deficiencies of Miyata. Accordingly, one of ordinary skill in the art would not have been led to modify the references to attain the claimed subject matter.

In view of the foregoing, applicants respectfully request that the rejection of claim 40 under 35 U.S.C. §103(a) as being unpatentable over Miyata in view of Okazaki or Imanari be withdrawn.

Claims 42, 43, 45, 46 and 48 were rejected under 35 U.S.C. §103(a) as being unpatentable over Adachi. Applicants respectfully traverse this rejection and submit that the teachings of Adachi do not disclose or suggest the subject matter recited in claims 42, 43, 45, 46 and 48.

Amended independent claim 42 is directed to a linear motion mechanism and requires a supersonic motor having a rotor which is rotationally driven by vibration of a vibrating body having a piezoelectric element, a first transmission member connected to the rotor for rotation therewith, a second transmission member having a first end portion for contacting the first transmission member and a second end portion, the second transmission member being mounted for undergoing pivotal movement about a pivoting point disposed between the first and second end portions, a moving body for contacting the second end portion of the second transmission member upon pivotal movement thereof to undergo linear movement in a direction crosswise to a longitudinal axis of a rotational shaft of the rotor in accordance with rotation of the first

transmission member, and a pressurizing mechanism for pressing the moving body into pressure contact with the second end portion of the second transmission member.

Amended independent claim 46 is directed to a pivotal motion mechanism and requires a supersonic motor having a rotor which is rotationally driven by vibration of a vibrating body having a piezoelectric element, a transmission member connected to the rotor for rotation therewith, a moving body mounted for undergoing pivotal movement about a pivot point in accordance with rotation of the transmission member, and a pressurizing mechanism for pressing the moving body into pressure contact with the transmission member.

Adachi does not disclose or suggest the structural combination of the linear motion mechanism and the pivotal motion mechanism recited in independent claims 42 and 46. As acknowledged by the Examiner, Adachi does not disclose or suggest a pressurizing mechanism for pressing the moving body into pressure contact with the second end portion of the second transmission member (claim 42) and a pressurizing mechanism for pressing the moving body into pressure contact with the transmission member (claim 46), as required by independent claims 42 and 46. Contrary to the Examiner's contention, one of ordinary skill in the art, at the time the invention was made, would not have been led to modify Adachi

to provide a pressurizing mechanism, as required by independent claims 42 and 46, as set forth above for independent claim 29.

Moreover, Adachi does not disclose or suggest a second transmission member having a first end portion for contacting the first transmission member and a second end portion, the second transmission member being mounted for undergoing pivotal movement about a pivoting point disposed between the first and second end portions, and a moving body for contacting the second end portion of the second transmission member upon pivotal movement thereof to undergo linear movement in a direction crosswise to a longitudinal axis of a rotational shaft of the rotor in accordance with rotation of the first transmission member, as required by independent claim 42. For example, in Adachi the second transmission member 6 does not undergo pivotal movement about a pivot point. Furthermore, in Adachi the moving body, which is not shown in the drawings but referred to in the abstract as an external body for undergoing linear movement, does not undergo linear movement in a direction crosswise to a longitudinal axis of a rotational shaft of the rotor, as required by independent claim 42.

Moreover, Adachi clearly does not disclose or suggest a moving body mounted for undergoing pivotal movement

about a pivot point in accordance with rotation of the transmission member, as required by independent claim 46. As noted above, the external body in Adachi undergoes linear, not pivotal, movement in accordance with rotation of the rotor.

Thus one of ordinary skill in the art would not have been led to modify Adachi in the manner proposed by the Examiner in the statement of rejection. The only basis for the modifications urged by the Examiner in the rejection is applicants' own disclosure, and such hindsight rejections are improper. See, for example, Diversitech Corp. v. Century Steps, Inc., 7 USPQ2d 1315, 1318 (Fed. Cir. 1988); In re Geiger, 2 USPQ2d 1276, 1278 (Fed. Cir. 1987); Panduit Corp. v. Dennison Manufacturing Co., 227 USPQ 337, 343 (Fed. Cir. 1985); Interconnect Planning Corp. v. Feil, 227 USPQ 543, 551 (Fed. Cir. 1985).

Claims 43, 45 and 48 depend on and contain all of the limitations of independent claims 42 and 46, respectively, and, therefore, distinguish from the reference at least in the same manner as claims 42 and 46.

Moreover, there is a separate ground for patentability of dependent claim 43 which includes the additional limitation that the moving body has a projecting portion for contacting the second end portion of the second transmission mechanism. No corresponding structure is disclosed or suggested by Adachi.

In view of the foregoing, applicants respectfully request that the rejection of claims 42, 43, 45, 46 and 48 under 35 U.S.C. §103(a) as being unpatentable over Adachi be withdrawn.

Claims 44 and 47 were rejected under 35 U.S.C. §103(a) as being unpatentable over Adachi in view of Okazaki or Imanari. Applicants respectfully traverse this rejection and submit that the combined teachings of Adachi and Okazaki or Imanari do not disclose or suggest the subject matter recited in claims 44 and 47.

Claim 44 and 47 depend on and contains all of the limitations of independent claims 42 and 46, respectively, and, therefore, distinguish from the reference to Adachi at least in the same manner as claims 42 and 46.

The Examiner cited the secondary references to Okazaki and Imanari for their disclosure of a position sensor and a servo loop for controlling a motor. However, Okazaki and Imanari clearly do not disclose or suggest a pressurizing mechanism for pressing the moving body into pressure contact with the second end portion of the second transmission member (claim 42) and a pressurizing mechanism for pressing the moving body into pressure contact with the transmission member (claim 46), as required by independent claims 42 and 46. Furthermore, Okazaki and Imanari do not disclose or suggest a

second transmission member having a first end portion for contacting the first transmission member and a second end portion, the second transmission member being mounted for undergoing pivotal movement about a pivoting point disposed between the first and second end portions, and a moving body for contacting the second end portion of the second transmission member upon pivotal movement thereof to undergo linear movement in a direction crosswise to a longitudinal axis of a rotational shaft of the rotor in accordance with rotation of the first transmission member, as required by independent claim 42. Likewise, Okazaki and Imanari do not disclose or suggest a moving body mounted for undergoing pivotal movement about a pivot point in accordance with rotation of the transmission member, as required by independent claim 46.

Since Okazaki and Imanari do not disclose or suggest the foregoing features recited in independent claims 42 and 46, from which claims 44 and 47 respectively depend, they do not cure the deficiencies of Adachi. Accordingly, one of ordinary skill in the art would not have been led to modify the references to attain the claimed subject matter.

In view of the foregoing, applicants respectfully request that the rejection of claims 44 and 47 under 35 U.S.C. §103(a) as being unpatentable over Adachi in view of Okazaki or Imanari be withdrawn.

The amendment to the claims made herein does not raise new issues requiring further search and/or consideration. Instead, independent claims 29, 36, 42 and 46 and allowed independent claims 49 and 50 have been amended to more broadly recite the elements of the supersonic motor which is one component of the linear motion mechanism (claims 29, 36, 42, 49, 50) and of the pivotal motion mechanism (claim 46), and a new abstract which reflects the invention to which the amended claims are directed has been substituted for the previously submitted abstract, thereby placing the application in condition for allowance or otherwise reducing the issues which remain for appeal.

In view of the foregoing amendments and discussion, the application is believed to be in allowable form. Accordingly, entry of this amendment and favorable

reconsideration and allowance of the claims are most respectfully requested.

Respectfully submitted,

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Bruce L. Adams

Attorney Name

Signature

July 29, 2002

Date